South Island Site in 'Dangerous' Condition

2.8 Site Eight - 5.3.98

- Location
- RCA
- Contractor
- Type of Work - Milling asphalt for patch repairs

A site of work, being carried out in a difficult location, close to an intersection controlled by traffic signals.

The worksite was made hazardous by incomplete signage and the installation of a cone taper which was too short. This resulted in insufficient advanced warning, to allow traffic to change lanes to pass the worksite.

Signage defects were :

- Advanced warning signs to close to worksite
- One lane signs used
- No RG-17 signs at start of cone taper
- No works end and derestriction signs
- Only signed in one direction
- Construction equipment was operating outside the safety zone.

Site 8 - 5.3.98 Looking South

Note : Short cone taper and lack of directional signage

- ***Site Danger Factor*** - 3000

- ***Recommendations***

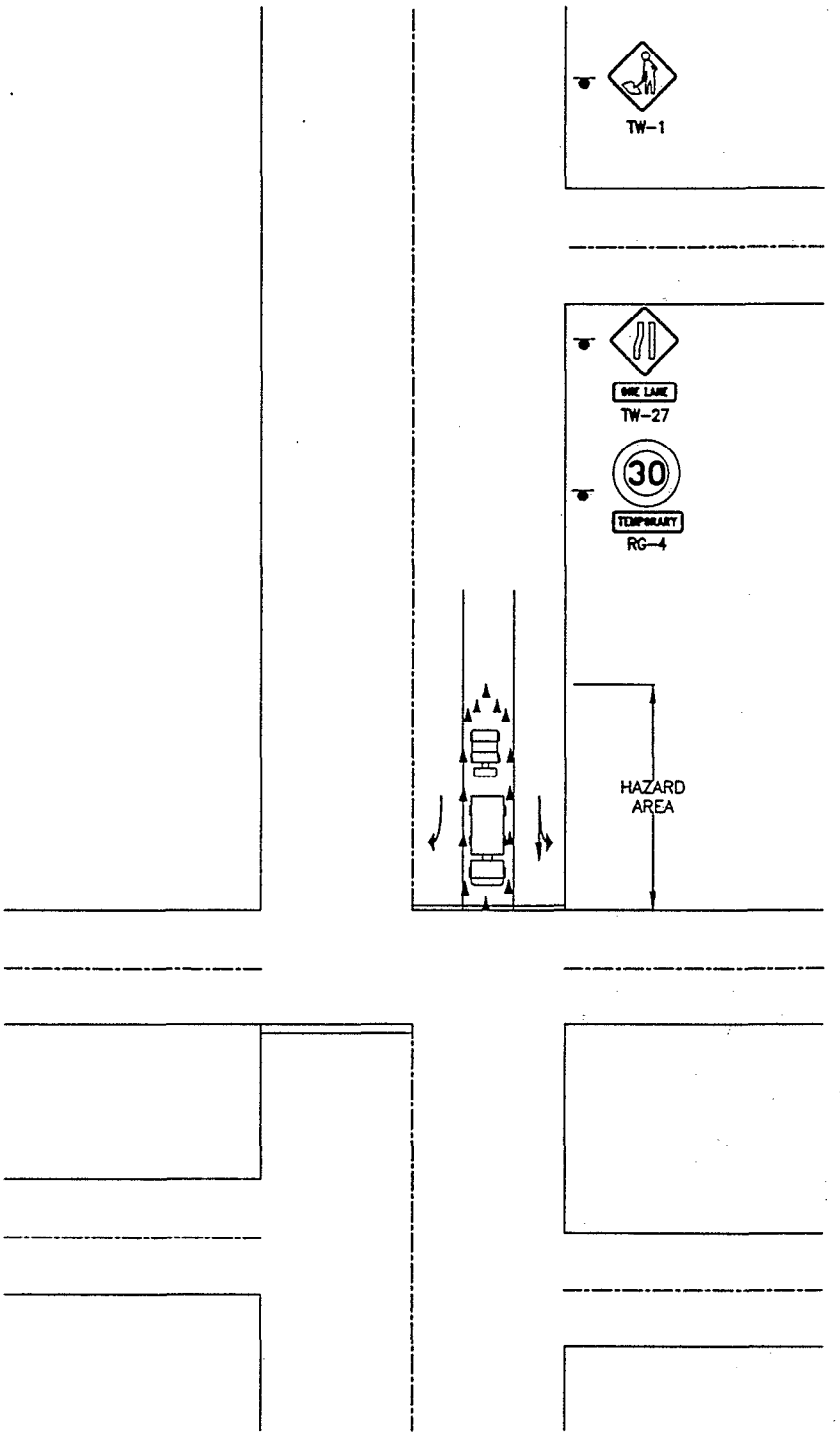
  Check Contractor's Traffic Management Plan, which should show:

  - Signage in both directions of travel
  - Advance warning signs are positioned in advance of the end of queued vehicles
  - Lane drop signs instead of one lane signs
  - Minimum 11 cone taper with RG-17 signs
  - End of works and derestriction signs

  Arrange for correct signs and delineation to be installed.

Site No. 8

SKETCH/DIAGRAM OF ACTUAL WORK SITE



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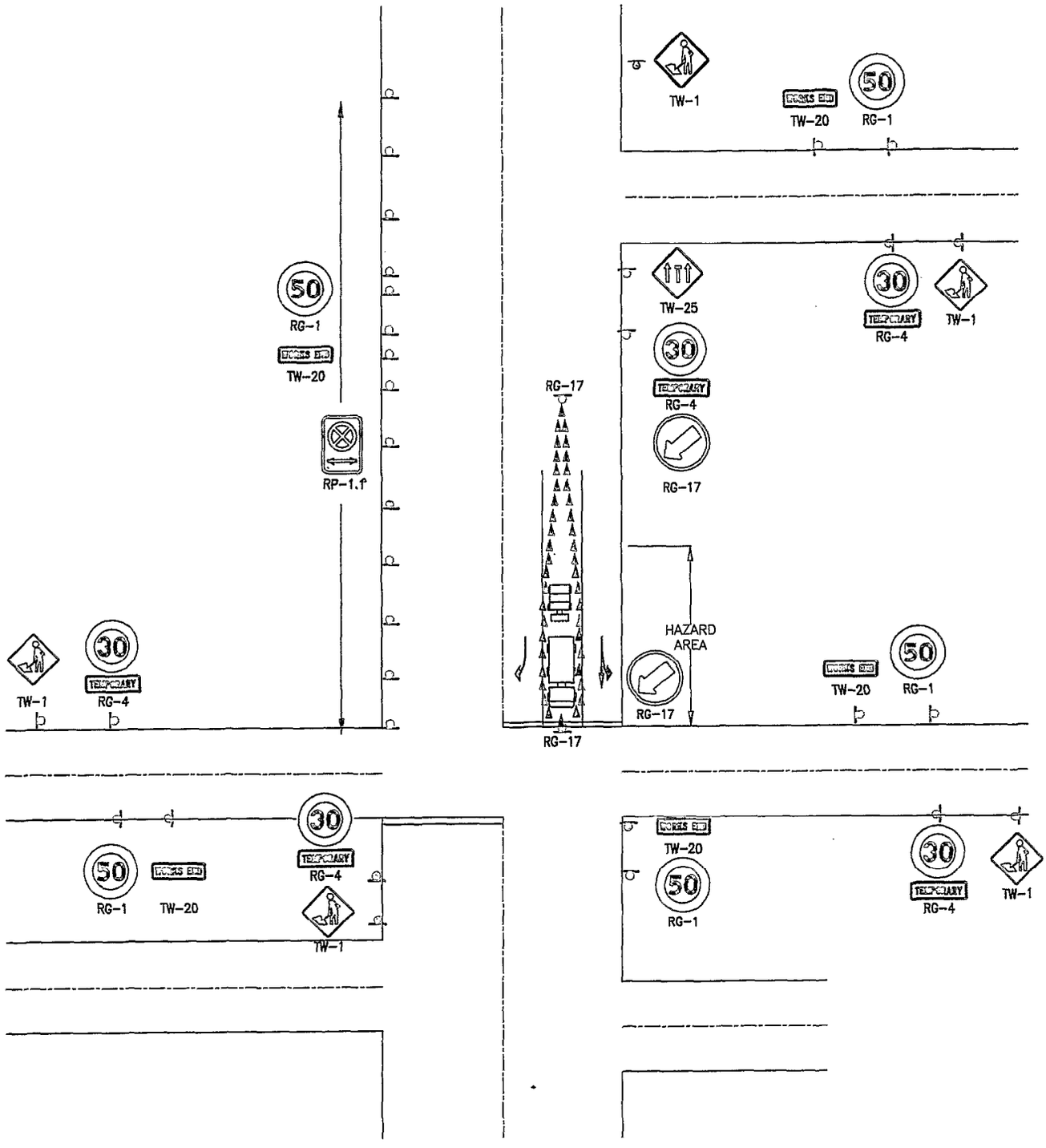
Site No. 8

SKETCH/DIAGRAM OF COMPLYING WORK SITE



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North Island
Site in 'Marginal' Condition

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Traffic Control at Worksite Safety Audit-Auckland North

Site Danger Factor Estimation Formula

Site No.	11	Site Danger Factor	150	
Site Description				
Road Controlling Authority 1				
Road Controlling Authority 2				
Contractor				

Site Protection Factors

All signs missing	50	
Deficiencies in:		
Sign Visibility Distance	10	
Sign Warning Distance	10	
Sign Spacing	10	
Cone Taper	10	
Cone Spacings	10	
Traffic protection inadequate	10	
Pedestrian/cyclist protection inadequate	10	
Wrong Sign used dangerously	10	
Working outside safety space	10	
High Visibility Vests not used/ineffective	10	
No intersections signed	10	10
TW 30 missing for stop/go control	10	
TW 24 used in 2 lane, 2 way road	10	
Flashing lights not used/ineffective	10	
Signs not safely visible at night	10	
Some signs omitted	5	
Some intersections not signed	5	
Wrong signs used not dangerous	5	
Sign sequence wrong	5	
Signs not legal	5	5
Sign Quality Unacceptable	5	
Permanent Signs not covered	5	
Some flashing lights not used/working	5	
Some signs wrong:		
Size	2	
Height	2	
Grade	2	
Sign quality marginal	2	
Total P Factor		**15**

Site Complexity Factor

Simple:	No intersections	1	
	2 lane-2 way, 1 way, 50 kph	1	
	low volume traffic	1	
Moderate:	Intersections/roundabouts	5	
	2 lane-2 way, 1 way, 50/70 kph	5	
	Medium traffic volume	5	
Complex:	Intersection/roundabouts	10	10
	2 lane-2 way, multi lane 80-100 kph	10	
	High traffic volume	10	
Total C Factor			**10**

Site Danger Factor

P Factor X	**15**
C Factor X	**10**
T Factor X	**1**
Site Danger Factor	**150**

Traffic Effect Factors

Works not in carriageway	1	1
Traffic staying in own lane	5	
Traffic moving from own lane-signed	10	
1 lane created no signs	20	
1 lane 2 way traffic created with no TW 27 RG 19 and RG 20 signs	20	
No temporary Lanes	20	
No traffic controller	20	
Total T Factor		**1**

SAFETY AUDIT - TRAFFIC CONTROL AT ROADWORKS SITES
NORTH AUCKLAND AND NORTHLAND

Site No.: 11
Recorded By: John Bevan
Date: 23-3-98
Approx. Time: 15-00
Location of Site:

Description of Work Type:
Road Controlling Authority:
Name of Contractor:

Prompts Y/N = Yes/No
A-S-N = All-Some-None

< Signage: **Comments:**

- Visibility (A)-S-N Elaborate layout of speed restriction signs
- Placement (A)-S-N well placed except that the corresponding
- Height (A)-S-N reinstatement of speed limits are missing
- Size (A)-S-N in both directions
- Quality
  - Acceptance (A)-S-N In addition 35 speed advisory plates on chevrons
  - Marginal A-S-N are not covered
  - Unacceptable A-S-N

< Delineation

- Cones A-S-N N/A
- Drums A-S-N N/A
- Barricades A-S-N N/A
- Other A-S-N N/A

< Protection

- Excavations Y/N N/A
- Pedestrians from work Y/N N/A
- Pedestrians from traffic Y/N N/A
- Cyclists from work Y/N N/A
- Cyclists from traffic Y/N N/A

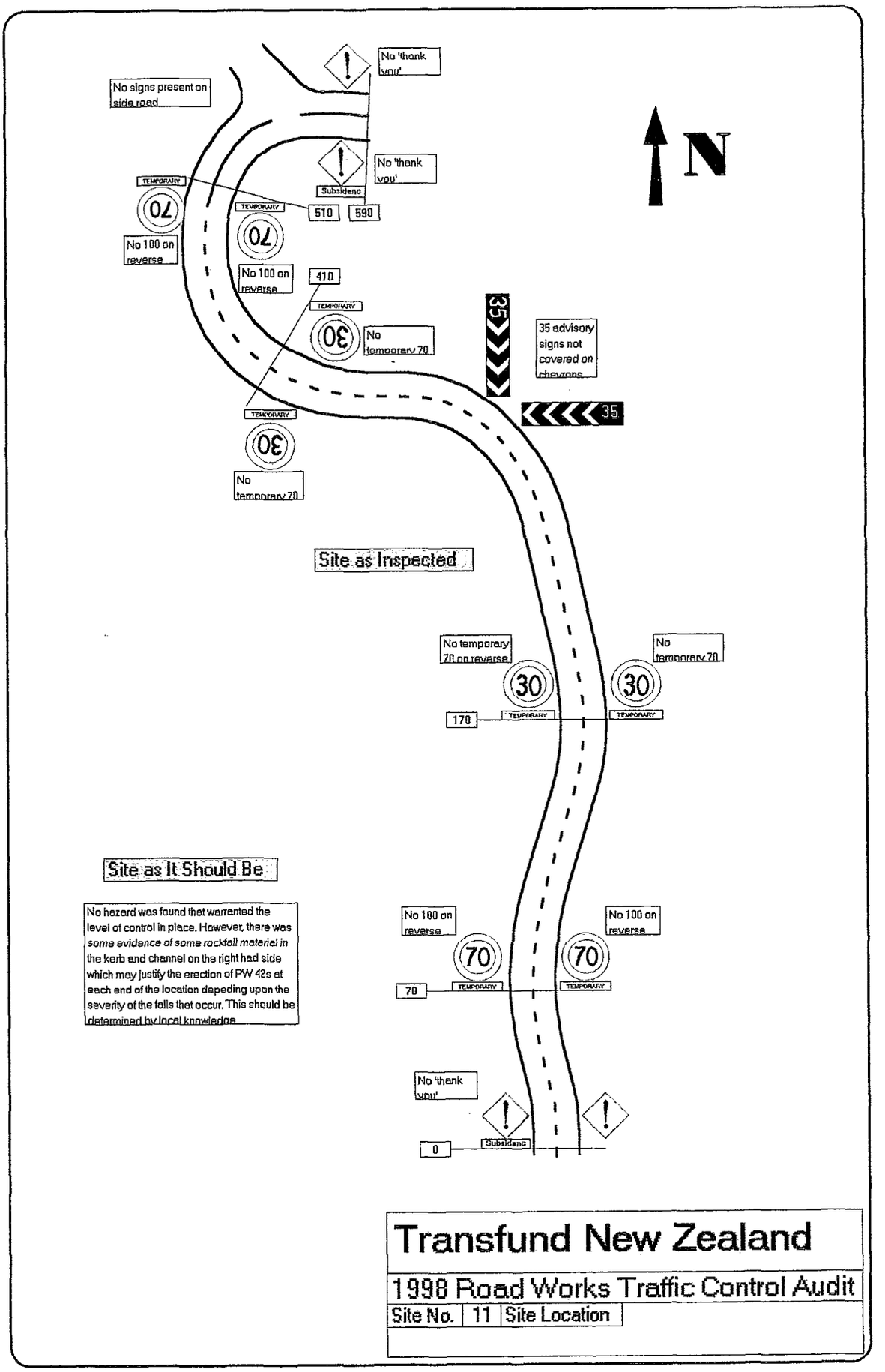
< Worksite Zone/Hazard Area

- Safety space A-S-N N/A
- Vehicle hazard lights A-S-N N/A
- Vehicles operating with traffic flow A-S-N N/A
- Vehicles parked with traffic flow A-S-N N/A
- Vehicles outside zone A-S-N N/A
- Entering/leaving with traffic flow A-S-N N/A
- Workers safety A-S-N N/A
- Site supervisor/traffic controller Y/N A-S-N N/A

<Principal Zones Correct

- Advance warning Y(N) The hazard was not readily identifiable
- Direction Y(N) and accordingly the need for the speed
- Protection N/A Y/N restriction is questioned
- End of works Y(N) No Thank You present in excess

Site Danger Factor: 150


No 'thank you'
No signs present on side road
No 'thank you'
Subsidence
TEMPORARY
70
510
590
No 100 on reverse
No 100 on reverse
410
TEMPORARY
30
No temporary 70
35
35 advisory signs not covered on chevrons
35
TEMPORARY
30
No temporary 70
N
Site as Inspected
No temporary 70 on reverse
30
TEMPORARY
170
30
TEMPORARY
No temporary 70
Site as It Should Be
No hazard was found that warranted the level of control in place. However, there was some evidence of some rockfall material in the kerb and channel on the right had side which may justify the erection of PW 42s at each end of the location depeding upon the severity of the falls that occur. This should be determined by local knowledge
No 100 on reverse
70
TEMPORARY
70
No 100 on reverse
70
TEMPORARY
No 'thank you'
Subsidence
0
Transfund New Zealand
1998 Road Works Traffic Control Audit
Site No. 11 Site Location

North Island
Site in 'Serious' Condition

SAFETY AUDIT - TRAFFIC CONTROL AT ROADWORKS SITES
NORTH AUCKLAND AND NORTHLAND

Site No.: 15
Recorded By: John Boyce
Date: 23-3-98
Approx. Time: 17-20
Location of Site:

Description of Work Type:
Road Controlling Authority:
Name of Contractor:

Prompts Y/N = Yes/No
A-S-N = All-Some-None

< Signage: **Comments:**

- Visibility A-(S)-N No signs present on main road approaches
- Placement A-(S)-N No 'Thank You' plate present. No 50
- Height (A)-S-N speed restriction signs present maintaining
- Size (A)-S-N permanent speed limit. No advance
- Quality warning signs present of any of the roads
  - Acceptance (A)-S-N approaching the site from the South or the
  - Marginal A-S-N East
  - Unacceptable A-S-N One speed restriction sign obscured by tree on Bay Street

< Delineation

- Cones A-S-N N/A
- Drums A-S-N N/A
- Barricades A-S-N N/A
- Other A-S-N N/A

< Protection

- Excavations Y/N N/A
- Pedestrians from work Y/N N/A
- Pedestrians from traffic Y/N N/A
- Cyclists from work Y/N N/A
- Cyclists from traffic Y/N N/A

< Worksite Zone/Hazard Area

- Safety space A-S-N N/A
- Vehicle hazard lights A-S-(N)
- Vehicles operating with traffic flow (A)-S-N
- Vehicles parked with traffic flow A-S-N N/A
- Vehicles outside zone A-S-N N/A
- Entering/leaving with traffic flow A-S-N N/A
- Workers safety A-S-N N/A
- Site supervisor/traffic controller Y/N A-S-N N/A

<Principal Zones Correct

- Advance warning Y(N)
- Direction Y/N N/A
- Protection Y/N N/A
- End of works Y(N) See above for details

Site Danger Factor: 1000

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Traffic Control at Worksite Safety Audit-Auckland North

Site Danger Factor Estimation Formula

Site No.	15	Site Danger Factor	1000	
Site Description				
Road Controlling Authority 1				
Road Controlling Authority 2				
Contractor				

Site Protection Factors

All signs missing	50	
Deficiencies in:		
Sign Visibility Distance	10	10
Sign Warning Distance	10	10
Sign Spacing	10	10
Cone Taper	10	
Cone Spacings	10	
Traffic protection inadequate	10	
Pedestrian/cyclist protection inadequate	10	
Wrong Sign used dangerously	10	
Working outside safety space	10	
High Visibility Vests not used/ineffective	10	
No intersections signed	10	
TW 30 missing for stop/go control	10	
TW 24 used in 2 lane, 2 way road	10	
Flashing lights not used/ineffective	10	
Signs not safely visible at night	10	
Some signs omitted	5	
Some intersections not signed	5	5
Wrong signs used not dangerous	5	
Sign sequence wrong	5	
Signs not legal	5	5
Sign Quality Unacceptable	5	
Permanent Signs not covered	5	
Some flashing lights not used/working	5	
Some signs wrong:		
Size	2	
Height	2	
Grade	2	
Sign quality marginal	2	
Total P Factor		**40**

Site Complexity Factor

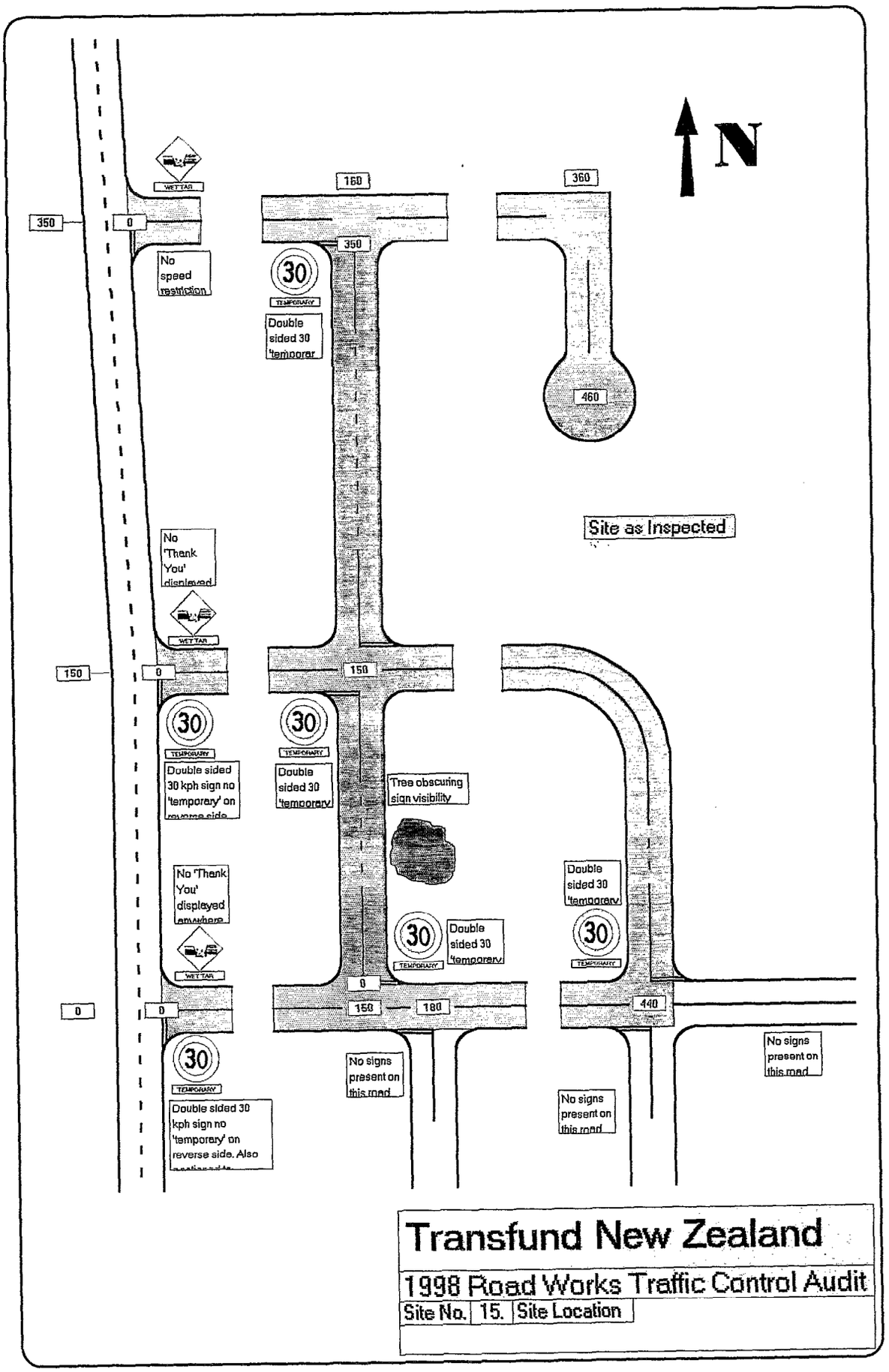
Simple:	No intersections	1	
	2 lane-2 way, 1 way, 50 kph	1	
	low volume traffic	1	
Moderate:	Intersections/roundabouts	5	
	2 lane-2 way, 1 way, 50/70 kph	5	5
	Medium traffic volume	5	
Complex:	Intersection/roundabouts	10	
	2 lane-2 way, multi lane 80-100 kph	10	
	High traffic volume	10	
	Total C Factor		**5**

Site Danger Factor

P Factor X	**40**
C Factor X	**5**
T Factor X	**5**
Site Danger Factor	**1000**

Traffic Effect Factors

Works not in carriageway	1	
Traffic staying in own lane	5	5
Traffic moving from own lane-signed	10	
1 lane created no signs	20	
1 lane 2 way traffic created with no TW 27 RG 19 and RG 20 signs	20	
No temporary Lanes	20	
No traffic controller	20	
Total T Factor		**5**


N
WET TAR
350
0
No speed restriction
160
350
30
TEMPORARY
Double sided 30 'temporar
360
460
Site as Inspected
No 'Thank You' displayed
150
0
Double sided 30 kph sign no 'temporary' on
Double sided 30 'temporary
Tree obscuring sign visibility
No 'Thank You' displayed anywhere
Double sided 30 'temporary
Double sided 30 'temporary
0
0
150
180
440
No signs present on this road
No signs present on this road
No signs present on this road
Double sided 30 kph sign no 'temporary' on reverse side. Also
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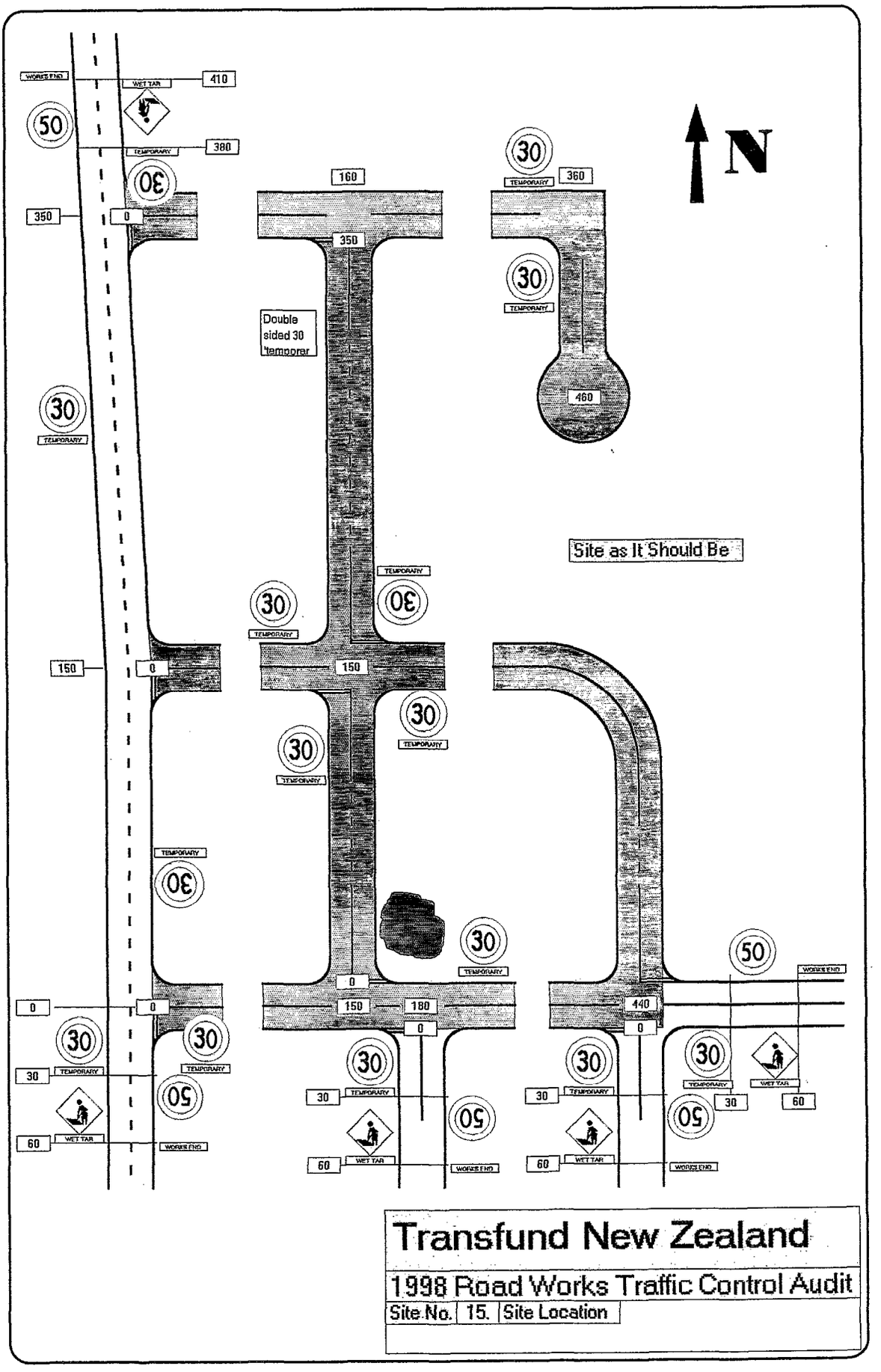
Site No. 15. Site Location



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1998 Road Works Traffic Control Audit

Site No. 15. Site Location

North Island
Site in 'Dangerous' Condition

Transfund New Zealand
Audit Report No. 98/699S *Status: Final 23/2/99*

SAFETY AUDIT - TRAFFIC CONTROL AT ROADWORKS SITES
NORTH AUCKLAND AND NORTHLAND

Site No.: 2
Recorded By: John Boyce
Date: 23-3-22
Approx. Time: 16-10
Location of Site:

Description of Work Type:
Road Controlling Authority:
Name of Contractor:

Prompts Y/N = Yes/No
A-S-N = All-Some-None

< Signage: **Comments:**

- Visibility A-S-(N) No Signs present
- Placement A-S-(N)
- Height A-S-(N)
- Size A-S-(N)
- Quality
  - Acceptance A-S-(N)
  - Marginal A-S-(N)
  - Unacceptable A-S-(N)

< Delineation

- Cones A-S-(N) No delineation present
- Drums A-S-(N)
- Barricades A-S-(N)
- Other A-S-(N)

< Protection

- Excavations Y/(N) N/A
- Pedestrians from work Y(N) Pedestrians forced onto road around operating excavator
- Pedestrians from traffic Y(N)
- Cyclists from work Y(N)
- Cyclists from traffic Y(N) Cyclists forced around operating excavator

< Worksite Zone/Hazard Area

- Safety space A-S-(N)
- Vehicle hazard lights A-S-(N)
- Vehicles operating with traffic flow (A)-S-N
- Vehicles parked with traffic flow (A)-S-N
- Vehicles outside zone (A)-S-N
- Entering/leaving with traffic flow A-(S)-N
- Workers safety A-S-(N)
- Site supervisor/traffic controller Y(N) A-S-(N)

<Principal Zones Correct

- Advance warning Y(N)
- Direction Y(N)
- Protection Y(N)
- End of works Y(N)

Site Danger Factor: 5000

Transfund New Zealand

Traffic Control at Worksite Safety Audit-Auckland North

Site Danger Factor Estimation Formula

Site No.	2	Site Danger Factor	5000	
Site Description				
Road Controlling Authority 1				
Road Controlling Authority 2				
Contractor				

Site Protection Factors

All signs missing	50	50
Deficiencies in:		
Sign Visibility Distance	10	
Sign Warning Distance	10	
Sign Spacing	10	
Cone Taper	10	10
Cone Spacings	10	10
Traffic protection inadequate	10	10
Pedestrian/cyclist protection inadequate	10	10
Wrong Sign used dangerously	10	
Working outside safety space	10	
High Visibility Vests not used/ineffective	10	
No intersections signed	10	
TW 30 missing for stop/go control	10	
TW 24 used in 2 lane, 2 way road	10	
Flashing lights not used/ineffective	10	
Signs not safely visible at night	10	
Some signs omitted	5	
Some intersections not signed	5	
Wrong signs used not dangerous	5	5
Sign sequence wrong	5	
Signs not legal	5	
Sign Quality Unacceptable	5	
Permanent Signs not covered	5	
Some flashing lights not used/working	5	5
Some signs wrong:		
Size	2	
Height	2	
Grade	2	
Sign quality marginal	2	
Total P Factor		**100**

Site Complexity Factor

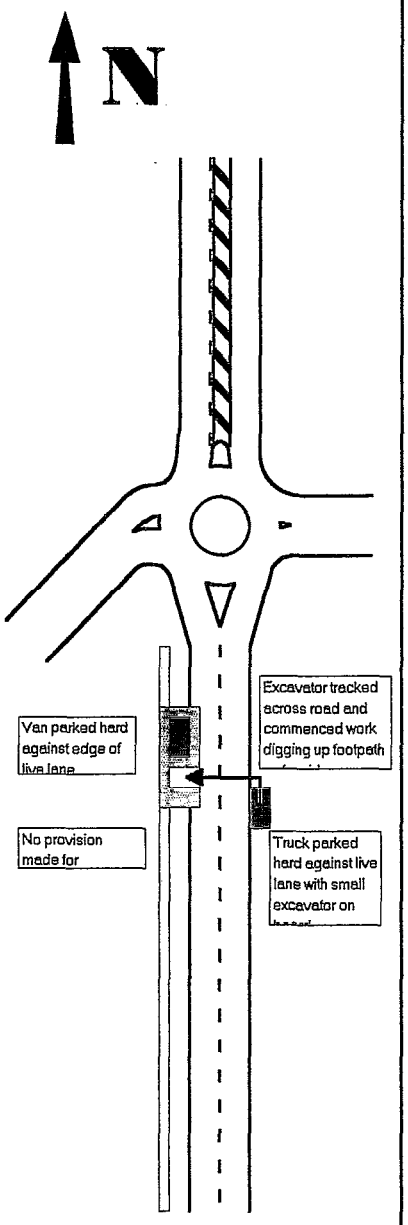
Simple:	No intersections	1	
	2 lane-2 way, 1 way, 50 kph	1	
	low volume traffic	1	
Moderate:	Intersections/roundabouts	5	
	2 lane-2 way, 1 way, 50/70 kph	5	
	Medium traffic volume	5	
Complex:	Intersection/roundabouts	10	10
	2 lane-2 way, multi lane 80-100 kph	10	
	High traffic volume	10	
	Total C Factor		**10**

Site Danger Factor

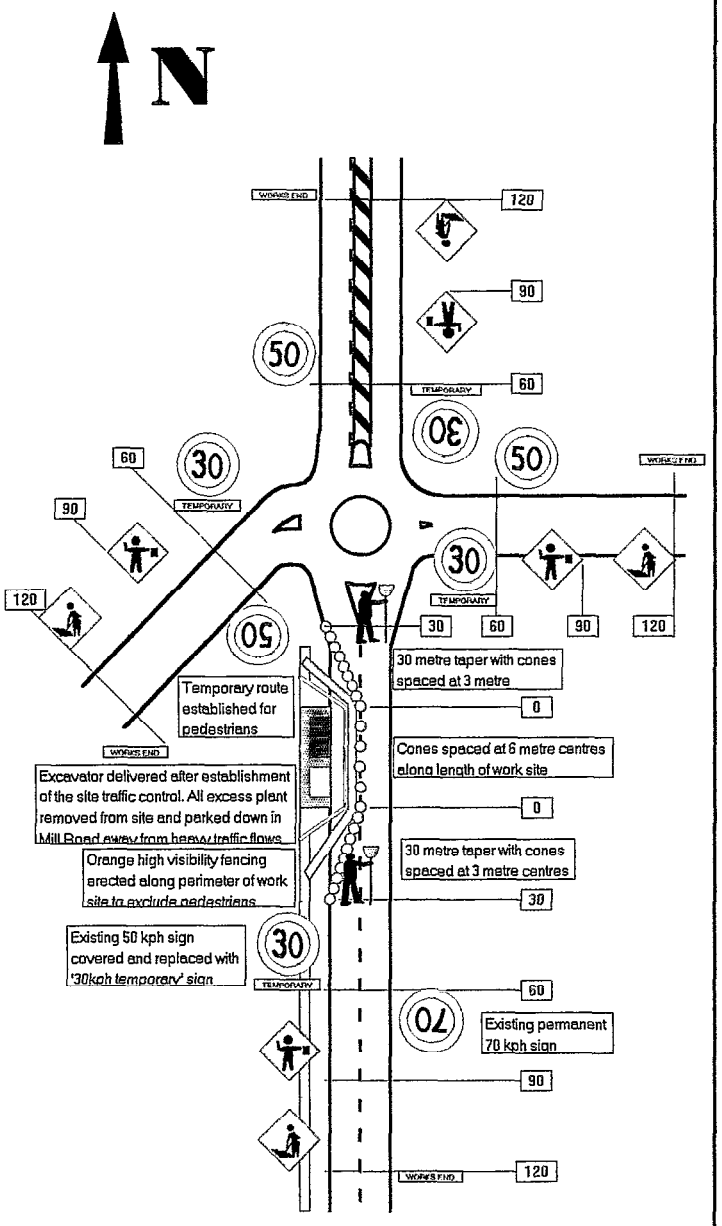
P Factor X	100
C Factor X	10
T Factor X	5
Site Danger Factor	**5000**

Traffic Effect Factors

Works not in carriageway	1	
Traffic staying in own lane	5	5
Traffic moving from own lane-signed	10	
1 lane created no signs	20	
1 lane 2 way traffic created with no TW 27 RG 19 and RG 20 signs	20	
No temporary Lanes	20	
No traffic controller	20	
Total T Factor		**5**



Site as Inspected



Site as It Should Be

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1998 Road Works Traffic Control Audit

Site No.	2	Site Location

Appendix IV

Land Transport Safety Authority

Road Crash Data at Road Work Sites

LAND transportsafety AUTHORITY

Traffic Safety at Road Works in New Zealand

Harold Sigthorsson
L.T.S.A.
Wellington,
10. 3. 1998

Contents:

Summary

Accidents at Roadwork Sites are over represented:

- where there is loss of control, especially bends
- at night
- on State Highways
- when speeding

Accidents at Roadwork Sites are under represented:

- on a wet road surface
- where alcohol is a factor

The fatal accidents at road works follow a similar pattern, except that the movements "loss of control" and "head on" become more common.

Traffic Accidents at Roadwork Sites in New Zealand

A study was carried out on accidents at roadwork sites in all New Zealand for the year 1996. Accidents were selected by using the codes 817, 824 and 825 in the LTSA Accident Investigation System database. The first code describes " road under construction and/or maintenance", the second "road works not adequately lighted" and the third "road works not adequately signposted". Together they should cover most of the reported accidents at roadwork sites. The total number of accidents was 213.

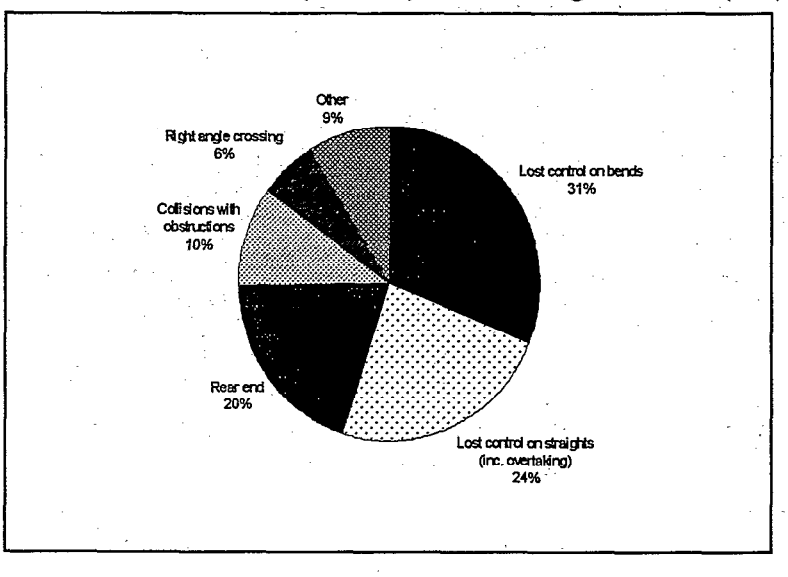
The total economic cost of these accidents was just over 19 million NZ $ per year. This was based on the Project Evaluation Manual. A large part of the costs were made up by the fatal accidents or around 13 million, so the costs could vary from year to year.

Of the 213 accidents 6 were fatal, 15 serious, 49 minor and 143 non-injuries. The percentages were 3, 7, 23 and 67 % respectively. The severity percentages for all New Zealand are 1 % fatal accidents, 7 % serious injuries, 23 % minor injuries and 69 % non-injuries. The accidents at roadwork sites are therefore more frequently fatal accidents and less frequently non-injuries than the average traffic accidents in New Zealand. In other words the severity is higher than the national average.

In the following there are pointed out some interesting features of the accidents at roadwork sites. It has to be borne in mind that the selection is only one year and no distinction is made between urban and rural areas.

Movement codes

The most frequent movement codes were "losing control on bends" (DA, DB + part of BE), "rear end accidents in queues" (FD, FF) and "losing control on straight road sections" (CA, CB, CC, AD + part of BE). They were followed by "hitting non-vehicular obstructions" (EC, ED) and crossing accidents (HA).

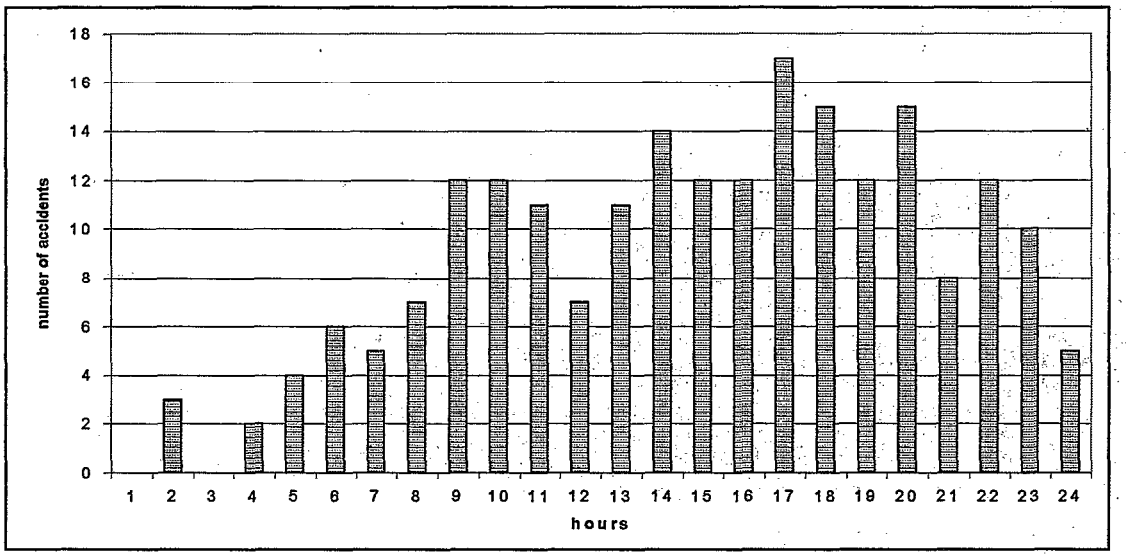


Road works are especially dangerous if they are on bends or on a section that includes bends. This certainly stands out. Queues can also cause danger. Driving off straight roads and hitting obstructions is secondary but none the less important.

On this basis it seems to be the gravel on the road or road surface with low friction, especially on bends, that causes the accidents, rather than the actual obstructions on the roadway. In addition to this the drivers do not seem to notice the queues in time. All this was often in connection with "driving too fast for conditions".

Time of day

Very little can be said about the distribution over the day unless it is compared with the distribution for traffic volumes. The afternoon and evening seem to be dangerous and on the whole the distribution is probably more evenly spread throughout the day than the traffic volume will be.



Darkness

Darkness is a very important factor in connection with accidents at roadwork sites. Of the total of 213 accidents, 93 (44 %) happened when dark and 120 (56 %) happened in other conditions. This may be an indication that signs and markings should be improved at night time, because traffic volumes are much lower during hours of darkness (< 20 % of the 24-hour volume).

32 % of all NZ accidents happened when it was dark for the year 1996 and the corresponding number for accidents at roadwork sites is 44 %. The number of accidents in darkness is in this case significantly higher for accidents at road works than for all accidents for the year 1996. Injury accidents follow the same pattern.

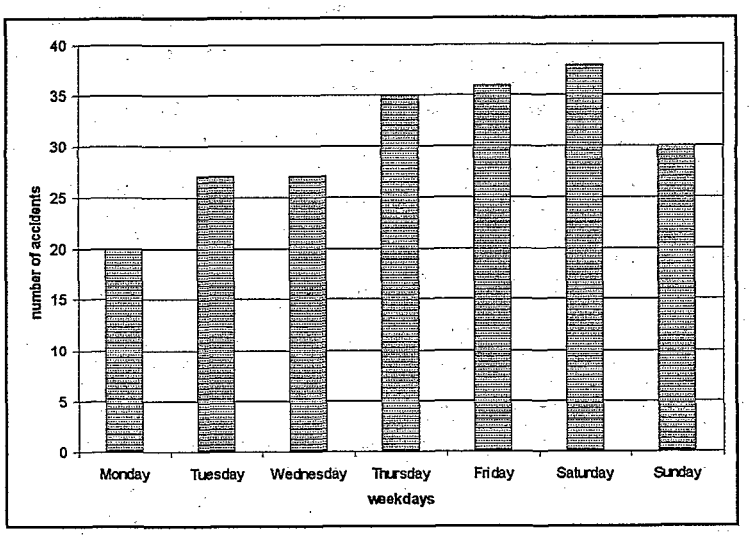
Wet road surface

The situation for accident numbers when the road surface is wet is not so clear. 158 road works accidents (74 %) happen when the surface is dry and only 55 (26 %) happen when it is wet. In all New Zealand 30 % of the accidents in 1996 happened when it was wet. In this case the increased number of accidents in dry conditions for

roadwork sites would not be significant. The estimation of wet road surface for unsealed road works sites could be different from that of sealed roads. Furthermore this factor could be typical of unsealed roads on the whole. Only just over 2% of accidents occurred on unsealed roads in 1996, 80 % in dry conditions and 20 % in wet. As road sections with road works have high accident rates they can be considered to cause danger both in dry and wet conditions.

The number of injury accidents when dry was 56 (80 %) and when wet 14 (20 %). The numbers are too small for statistical tests.

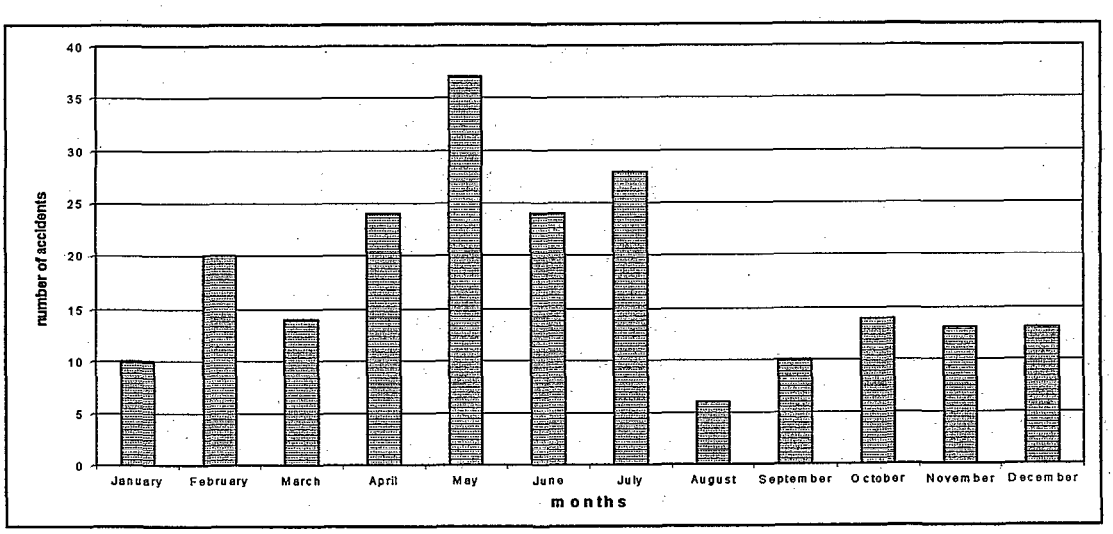
Day of the week



Accidents are more frequent towards the end of the week with Thursday Friday and Saturday as the three highest days. The two latter days could be connected to weekend activity and nighttime accidents.

Month of the year

April to July seems to have the highest number of accidents, with May as an absolute peek. This is the end of the construction year and this could simply mean more roadwork sites than usual. Average speeds are higher at wintertime and this could be reflected in the numbers.



Percentages on State Highways

The percentage of roadwork accidents on State Highway roadwork sites is 67 % for fatal and serious accidents, 59 %for minor injuries and 64 % for non-injuries. The numbers for all New Zealand are respectively 52 %, 40 %, 32 % and 29 %. In comparison more roadwork accidents happen on State Highways than on the road network in general. This indicates that the State Highways should be a major concern in future studies. This may reflect higher traffic volumes on State Highways and higher speeds. The latter contributing factor could be the reason for a higher percentage on State Highways with higher severity.

Alcohol and speed

Only 6 accidents (9%) of 70 injury accidents have alcohol as a contributing factor, 27 (39%) of 70 have speed. The corresponding percentages for all New Zealand are 17 % for alcohol and 18 % for speed. According to this alcohol is not an importing factor in connection with accidents at road works. Speeding however can be regarded as an important cause code in this case.

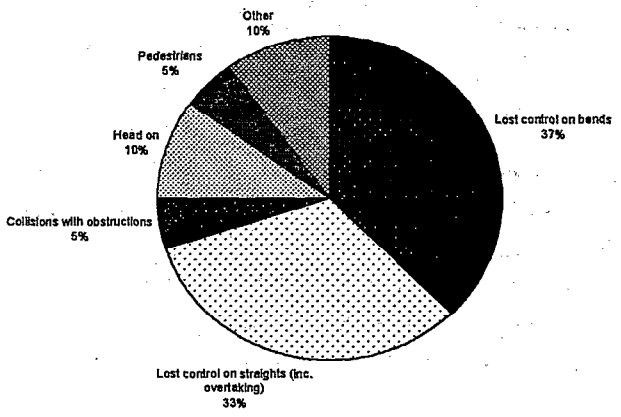
Appendix 1

Fatalities at Roadwork sites in New Zealand

A study was carried out on fatalities due to traffic at road works in New Zealand for the 10-year period of 1987 to 1996. Same codes were used to define the road works as before. The total number of fatal accidents was 40 or 4 each year on average.

Movement codes

Similar method as before was used to group the movement codes together. The groups turned out to be slightly different for fatal accidents than for all accidents:



Rear end and right angle accidents cease to exist as dangerous movements and instead head on and pedestrian accidents become more marked. Accidents due to loss of control increase, but collisions with obstructions decrease. This reflects partly the common knowledge that severity is higher in head on accidents than rear end accidents.

Time of day

Very little can be said about the distribution over the day because the numbers here are too low to get a statistical distribution. The distribution appears to be similar to the distribution for all accidents at road works, with slightly higher evening and nighttime occurrence.

Darkness

Of the total 40 fatal accidents, 19 (48 %) happened when dark and 21 (52 %) happened in other conditions. This is again an indication that traffic safety at roadwork sites needs to be improved at nighttime, because traffic is indeed much lower during those hours. About half of all fatal accidents in New Zealand happen when dark, so this result seems to be in line with that.

Wet road surface

Of 40 fatal accidents 8 happened when wet (20 %) and 32 (80 %) in dry conditions. The corresponding figures for all New Zealand are 26 % for wet road surface and 74 % for dry. There seems to be a slight tendency for the accidents at road works sites to occur when dry rather than wet. It has to be kept in mind that the roadwork sites contain a lot of unsealed road sections, whereas the majority of roads in New Zealand do not. Only just over 3 % of fatal accidents in New Zealand occur on unsealed sections, 79 % of these when dry and 21 % when wet.

Day of the week

Again the numbers are too low to make a statistical comparison, but Saturday seems to have had very many fatal accidents and Sunday very few.

Month of the year

Numbers are too low to show a distribution.

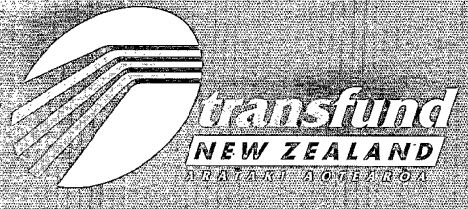
Percentages on State Highways

The percentage of roadwork fatal accidents on State Highways is 63 %, which is much higher than the New Zealand average of 48 %. It is therefore quite clear that more fatal accidents happen on the sites on State Highways than on other sites in the road network. More sites on State Highways could cause this, higher volumes or higher driving speeds in general. Better signage and markings are most probably used on State Highways than elsewhere, but that fact doesn't seem to keep up with the increased risk.

Alcohol and speed

Alcohol as a cause code is reported in 13 cases of 40 or 33 %. Speed on the other hand is reported in 27 cases of 40 or 68 %. The New Zealand average relates 41 % to alcohol and only 37 % to speeding for all fatal accidents that occurred 1987 to 1996. Alcohol is therefore less frequently mentioned as a reason for fatal accidents at road works than elsewhere, but speed much more frequently. This is in line with the trend for all roadwork accidents.

HSS 10/3/98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